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The strategic function of quality in the
management of innovation

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Keywords Quality, Innovation, Strategy. Management

Abstract Quality management can be used to support strategically the management of innovation. Tools in strategic quality management can be useful in: creating the organizational conditions in which innovations can be developed; supervising and initiating innovation processes; producing innovation content; and implementing innovations in the primary processes of the organization. This conclusion is based on the results of a research project in the Dutch construction industry. In a large-scale house building project the supportive use of quality tools in the management of innovation was studied. The study indicates that quality tools are used implicitly and sometimes explicitly to manage innovation processes.

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1. Introduction

Organizations that want to develop new products often analyze innovative products of successful competitors and use this as a benchmark. Many organizations that want to be innovative generate new ideas by listening to the members of their quality teams, or by measuring customer satisfaction. Benchmarking, quality teams, and customer satisfaction measurement are tools in quality management that can be supportive to the management of innovation. The relation between ‘quality’ and ‘innovation’ (Juran, 1964; Imai, 1986; Keogh and Bower, 1997) and the supportive function of quality in the management of innovation is often emphasized (Kanji, 1996; Chapman et al., 1997; Kanji, 1999) and are the central themes of this article. The article is based on results of a research project that was carried out in the Dutch construction industry. The article concentrates on the supportive function of strategic quality management tools in the management of innovation processes. The central research question is:

Does quality management have a strategic function in the management of innovation?

The research question is split into three sub questions:

1. What are the basic concepts in strategic quality management?
2. Which quality tools can be distinguished within these basic concepts? and



3. Do these tools support the management of innovation processes?

To give answers to these questions a research project is designed and carried out. The research design, data collection methods and data analysis, and limitations of the research design are described in the **second** section. A literature study is carried **out**. On the basis of this study three **basic** concepts of **strategic** quality management are distinguished, and several quality tools that are used within these concepts are gathered and presented. The concepts and tools are described in the third section. A case study is carried out in the Dutch construction industry. In this case five different innovation processes are distinguished. In the fourth section these innovation processes are described, and an overview is given of the feasibility of the **strategic** quality management tools in the management of the innovation processes. The article is ended with a conclusion that is based on the research findings.

2. Research methodology

In this section the research design, data collection methods, data analysis method and the limitations of the research design are described.

Research design

The research consists of a literature study and a case study. The aim of the literature study is to make an overview of different concepts and tools in **strategic** quality

management. The aim of the case study is: (1) to identify innovation processes and (2) to observe and describe which of the concepts and tools in **strategic** quality management are used to support the management of the innovation processes. The overview of concepts and tools in **strategic** quality and the overview of innovation processes are **combined** into a descriptive framework. The descriptive framework is used to organize and describe the supportive use of tools in **strategic** quality management in the management of innovation.

Data collection

A house **building** project named ‘Oikos’, situated in the municipality of Enschede in the Netherlands, was studied intensively during a 3-year-period. In the Oikos project 40 private and public organizations developed a housing estate with a market value of 50 million Euro. The Oikos project is innovative in the field of sustainability (or environmentally friendliness). Fifteen different disciplines, like: ‘town and country planning’, ‘traffic affairs’, ‘architecture’, and ‘engineering’, are integrated in the designs and 10 different innovative sustainable designs for town and country planning and 600 mutually different innovative designs for sustainable houses were developed and realized in the Oikos project.

In this single case study several research methods were used: study of **documents**; in-depth interviews with key informants; and in-depth observations in meetings. between representatives of innovating organizations (**Brewer and Hunter**, 1989; Kumar et al., 1993; Yin, 1994). In the case study more than 160 **documents** were gathered and studied, 28 interviews were taken, and **almost** 70 hours spent on observations (see table 1).

Table 1. Data collection methods

Research <i>method</i>	Case study
<i>Period</i>	3 years
<i>Study of documents</i>	160 documents: <ul style="list-style-type: none">• 40 agreements• 33 design documents• 18 decision supportive reports• 15 contracts• 14 brochures• 12 meeting agenda's and minutes• 10 letters• 7 project plans• 6 evaluation reports• 5 planning procedures/schedules
<i>In-depth interviews</i>	28 interviews with key informants in the studied case: <ul style="list-style-type: none">• 14 interviews with project managers, local authority• 4 interviews with managing directors, architect's firm• 4 interviews with managers, construction company• 2 interviews with managers, public housing local authority• 2 interviews with managing directors, real estate agency• 1 interview with managing director, consultant's firm• 1 interview with managing director, housing corporation
<i>In-depth observations</i>	69 ½ hours of observation of meetings: <ul style="list-style-type: none">• 43 ½ hours in meetings of representatives of local authorities, consultants' firms, energy companies, and pressure groups• 14 hours in meetings of representatives of local authorities, architects' firms, contractors, real estate agents, and consultants' firms• 12 hours in meetings of representatives of local authorities, architects' firms, contractors, real estate agents, and consultants' firms

Data analysis

The descriptive framework is used to organize and describe the use of tools in strategic quality management in the management of innovation processes. Each quality tool is analyzed for what purpose it was used in the Oikos project (Yin, 1994).

Limitations of the research design

The first limitation of the research design is that the results can not be statistically generalized. Another limitation of the research is that it does not focus on management

aspects that play a significant role in the management of sustainable innovations in the Dutch construction industry, such as: leadership, innovation champions, availability of innovative technologies, and social interaction between innovators (Silvester, 1996; Tjallingii, 1996; Van Hal, 2000). A third limitation of the research is that innovation processes that are not supported by concepts and tools in strategic quality management are not studied.

3. Strategic quality management: concepts and tools

In this section the descriptive framework is presented. This framework is based on the literature study and consists of three basic concepts of strategic quality management. These concepts contain several quality tools.

Strategic quality management appears to be both a concept and a toolkit. Three strategic quality management concepts and a great number of related tools are developed in practice. Conceptual elements of strategic quality management that are frequently mentioned in the literature, are: the strategic function of quality (Kennerfalk and Klefsjö, 1995; Smith and Angeli, 1995; Calingo, 1996; Madu et al., 1996); the integration of quality into the strategy of the organization (Aravindan et al., 1996; Tummala and Tang, 1996; Chapman et al., 1997; Ittner and Larcker, 1997); and an organizational orientation towards processes and teamwork (Kennerfalk and Klefsjö, 1995; Calingo, 1996; Anand, 1996):



The strategic function of quality

This concept represents the awareness of quality as an aspect that is of strategic importance to the organization, and the influence of customer satisfaction on the strategic position of the organization in its environment (Kennerfalk and Klefsjö, 1995; Smith and Angeli, 1995; Calingo, 1996; Madu et al., 1996).

The integration of quality in the strategy of the organization

This concept represents the establishment of a quality mission, the development of a quality policy, and the implementation of quality goals in the organization. The aim of these activities is to make the quality aspect an integral part of the overall strategy of the organization (Aravindan et al., 1996; Tummala and Tang, 1996; Chapman et al., 1997; Ittner and Larcker, 1997).

An orientation towards processes and teamwork

This concept represents the participation of middle managers and employees in the implementation processes of the quality strategy, and the participation of middle managers and employees in day-to-day working processes in the organization. In this concept the development of problem-solving skills is considered to be important (Kennerfalk and Klefsjö, 1995; Calingo, 1996; Anand, 1996).

These three basic concepts of strategic quality management contain many quality tools. Quality tools that are used in organizations to instrument these conceptual elements of

strategic quality management are hsted in table 2 (Kennerfalk and Klefsjö, 1995; Smith and Angeli, 1995; Anand, 1996; Aravindan er al., 1996; Calingo, 1996; Madu et al., 1996; Tummala and Tang, 1996; Chapman et al., 1997; Ittner and Larcker, 1997).

Table 2. Concepts and tools in strategic quality management

Concepts of strategic quality managomcnt	Quality tools
Strategic function of quality	Benchmarking programmes Training and education programmes Customer satisfaction measurement Employee satisfaction measurement ISO 9000 systems Review programmes
Integration of quality in strategy	Quality strategy development Quality planning Policy deployment Goal stretchingcontinuous improvement ISO 9000 systems Information systems
Orientation towards processes and teamwork	Concurrent engineering programmes Quality function deployment Business process redesign Plan-do-check-act Process management Training and education programmes ISO 9000 systems Quality circle programmes Information systems Failure analysis systems Quality costsanalysis Inspection routines Statistical quality tools Audit programmes Quality competitions Team-based problem-solving Award and recognition programmes

4. Innovation processes and supportive quality tools

In this section the innovation processes that are distinguished in the case study in the Oikos project are described. After a description of the five innovation processes an



overview is given of the possibilities to use the quality tools to support the management of these innovation processes.

The management of innovation can be divided into five distinctive processes: the creation of an innovation context; the supervision of innovation processes; the initiation of innovation processes; the generation of innovation content; and the implementation of innovation results in the organization.

Creating innovation context

Innovation projects were defined, inside and outside the organization. Professional clients, designers and contractors developed and realized innovations in close cooperation with each other. In the Oikos project nine different configurations, each consisting of a professional client, an architect, and a construction company, were established. These configurations developed the designs for the sustainable houses. Also a configuration was established to develop a sustainable design for town and country planning. This configuration consisted of departments of the municipality of Enschede, an architect's firm and several professional clients. Their ambitions in the field of sustainability were described as follows:

- Contribute to the development and preservation of the natural environment;
- Sustainable use of materials and energy sources.

The innovation context was also defined in financial terms. The organizations that participated in the projects were aiming at:

- . Making a profit on the every project; and

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- Developing houses that could be easily marketed.

Supervising innovation processes

Governance bodies were established to manage and **co-ordinate** the innovation processes in the innovation projects. In these governance bodies employees, representing the innovating organizations in the configurations, negotiated about **co-operative** innovation programmes. In all nine house building configurations and in the configuration for the development of a design for town and country planning, governance bodies were established. These governance bodies consisted of members of the organizations that considered themselves as innovators.

Initiating innovation processes

Innovation processes were initiated by so-called ‘innovation leaders’ and ‘innovation champions’. Innovation leaders felt, or actually were, responsible for **managing** the processes in the innovation projects. In **every** configuration one or two innovation leaders were **acting** as stimulators and facilitators of the innovation process. Innovation leaders based their leadership on knowledge about sustainable designing and building, their formal responsibility for the degree to which sustainable innovations would be developed, on enthusiasm, or on responsibility for a sustainable development of the society. Most of the innovation leaders based their leadership on a combination of these aspects. Innovation champions were actually developing innovative ideas and putting them into **practice**. Most of the innovation champions based their innovative input to the process on the back-up they **received** from their innovation leaders, on their ability and

flexibility to search for innovative solutions, their enthusiasm and their felt responsibility for a sustainable **development** of the society. Like most of the innovation leaders, most of the innovation champions also based their innovative contributions on two or more of these **aspects**.

Producing innovation content

Innovative ideas and concepts were developed. Discussion meetings were organized to **discuss** and evaluate innovative ideas and concepts. In the time-span between meetings the innovative ideas and concepts that were positively judged, were developed in detail, and were presented and **discussed** in the next discussion meeting. Three discussion meetings were organized by a department of the municipality of Enschede and were joined by representatives of all 10 configurations. The discussion meetings **secured** that innovations were tuned to one other.

Implementing innovation results

Innovation results were implemented in the primary **processes** of the organizations. In the innovation **processes** many innovations were developed. The configurations **selected** methodologies, checklists, and **scoring** methods for sustainable designing. The methodologies provided them with a set of guidelines for sustainable designing. In the checklists these guidelines were translated into sustainable design methods, techniques and solutions. In the **scoring** methods - that were officially approved by the Dutch government - points were attributed to the optional design methods, techniques and

solutions. The configurations all developed designs for houses and town and country planning with a high sustainability score.

Many tools in strategic quality management can be used to manage these innovation processes. In table 3 an overview is given of usable quality tools in the five distinguished innovation processes. This is a framework for the description in the next section of the quality tools that are supportive to the management of innovation processes in the Oikos project.



Table 3. Quality tools with a supportive function to innovation processes

Quality concepts and tools	Innovation processes				
	Creating innovation context	Supervising innovation processes	Initiating innovation processes	Producing innovation content	Implementing innovation results
Strategic function of quality: Benchmarking programmes Training and education programmes Customer satisfaction measurement Employee satisfaction measurement ISO 9000 systems Review programmes			X X X X		X X X X X
Integration of quality in strategy: Quality strategy development Quality planning Policy deployment Goal stretching/continuous improvement ISO 9000 systems Information systems	X X X X			X X X X	 X X
Orientation towards processes and teamwork: Concurrent engineering programmes Quality function deployment Business process redesign Plan-do-check-act Process management Training and education programmes ISO 9000 systems Quality circle programmes Information systems Failure analysis systems Quality costs analysis Inspection routines Statistical quality tools Audit programmes Quality competitions Team based problem solving Award and recognition programmes	X	 X X	 X X X X	X	 X X X X X X X X X X X X X

5. Quality management of innovation processes in the Dutch construction industry

In this section a description is given of the quality tools that were used to support the management of the innovation processes in the Oikos project. This description is made with the help of the descriptive framework. This section starts with a description of the



quality tools that are used explicitly in the management of innovation processes in the case studied, and will continue with a description of the quality tools that were primarily used for the management of quality, but unintentionally contributed to the management of innovation, and will end with a brief discussion of the research findings.

The case study points out that many tools in strategic quality management, which are theoretically supportive to the management of innovation (see table 3), actually do support the management of innovation. The case study also indicates that most tools are primarily used for the management of quality and are not explicitly used for their supportive function in the management of innovation.

Few quality tools were explicitly used by managers to support the management of innovation processes:

Creating innovation context

Quality planning was used to create innovation context. It was used to decide on the level of innovation ambition.

Supervising innovation processes

The plan-do-check-act cycle was used to supervise innovation processes. It was used to support the governance bodies in managing and co-ordinating the processes in the innovation projects. Members of the governance body went through the cycle many times to assure that innovation goals were coherent and contributed to the interests of their



organizations. In the studied case many innovations were **accepted** in the ‘plan phase’, appeared to be incompatible with the interests of some of the organizations, and were rejected in the ‘do phase’.

Initiating innovation processes

Benchmarking programmes were used to initiate innovation processes. Benchmarking was used to copy innovations that were developed by organizations in sustainable construction projects in the near past. In the Oikos project a consultant’s firm produced an overview of contractors and designers that had participated in innovative sustainable construction projects before. The same consultant’s firm also produced a checklist with sustainable design possibilities. These overviews were based on past experiences with sustainable housing projects and were used as **baseline documents** in the design processes of the houses.

The plan-do-check-act cycle was also used to manage the start-up of innovation processes, and to **cope** with uncertainties and resistance to change. In the Oikos project innovation leaders produced detailed planning sheets and procedures and made sure that everybody **who** was involved, agreed with it.

Producing innovation content

Quality planning was used to **produce** innovation content. It was used to plan the innovation **objectives** in a 1-year period. **Each** year the organizations decided which percentage of their activities would be dedicated to the designing and **building** of sustainable houses.

Implementing innovation results

Quality competitions were used to implement innovation results. They were used to stimulate innovation leaders and champions in their innovation activities. In the Oikos project three architects participated in a contest for sustainable designing and received a decoration. Also, the design for town and country planning was decorated for its sustainability.

The other quality tools that were used, were primarily used to manage quality, but implicitly contributed to the management of innovation:

Creating innovation context

Quality strategy development, policy deployment, goal stretching and continuous improvement, and concurrent engineering programmes did contribute to the creation of innovation context.

Quality strategy development was used to determine which innovations the organization needed in the coming 5 years. The Dutch government and the customers appeared to be important stakeholders. Governmental regulations forced many organizations to put effort in developing innovative sustainable houses. In addition to this the environmental awareness of potential buyers increased. Organizations expected that, in the coming years, sustainable houses will be perceived as 'high quality'.



Policy deployment contributed to the implementation of the innovation strategy in the organizations and created **space** for internal **or** external innovation projects. In the Oikos project more than 20 innovative projects were established.

Goal stretching and continuous improvement were used by the organizations to follow changes in demands. In the studied case the sustainability demands **changed** on a **regular** basis. Goal stretching and continuous improvement increased the organizations' capability to **react** to these changes.

Concurrent engineering programmes were used in both the internal and the external innovation projects. Multi-disciplinary teams were formed to develop and build innovative sustainable housing concepts. Design and construction functions were integrated.

Supervising innovation processes

There were no quality **tools** that implicitly contributed to the supervision of innovation processes.

Initiating innovation processes

Process management and customer satisfaction measurement were used by innovation leaders and champions and contributed to the initiation of innovation processes.

Process management was used to manage the start-up of innovation processes and to **cope** with uncertainties and resistance to change.



Customer satisfaction measurement was used to start developing innovations that fit with the **wishes** of potential buyers. In the Oikos project potential buyers were interviewed and results of customer satisfaction measurements of past projects were used.

Producing innovation content

The quality tools: quality strategy development, quality planning, policy deployment, goal stretching and continuous improvement, and concurrent engineering programmes contributed to the development of innovative ideas and concepts.

Quality strategy development and quality planning were used to **decide** on the **level** of ambition. In case innovative ideas or partially developed innovations were rejected, the **ambition level** remained standing and provided inspiration for new innovative ideas. In the Oikos project **many** innovative ideas were rejected in discussion meetings. Innovation leaders and champions derived **courage** from the agreed **ambition level**, and went on generating new innovation concepts.

Policy deployment was used to inform innovation champions about the **ambition level**. Innovation leaders managed that the **ambition level** was recognized by **many participants** in the innovation projects.

Goal stretching and continuous improvement were philosophies that functioned as guidelines for improvement of innovative concepts.

Concurrent engineering was used to maintain awareness of the engineering and production capabilities of the organization, from the beginning till the end of the innovation **process**. It protected the organization from developing illusions instead of innovations. In the innovation **processes** in the studied case designers and constructors



assessed which innovations could be produced, and real estate developers determined which innovations could be successfully marketed.

Implementing innovation results

ISO 9000 systems, information systems, audit programmes, review programmes, and team-based problem-solving contributed to the implementation of the results of the innovation projects in the primary processes of the organizations.

ISO 9000 quality systems were used by organizations to assure that innovation capabilities that were developed in the innovation projects became integrated in their primary processes.

Information systems were used to store and gain access to the information that was needed to develop sustainable innovations. In the design processes in the case studied designers used databases containing information about the sustainability of several design options.

Audit and review programmes were used to measure and assure a certain level of sustainability. In the Oikos project, for example, a consultant's firm was hired to audit and review the sustainability of the designs. All designs scored above a relatively high level of acceptance.

Team-based problem-solving was used to integrate distinctive disciplines and to work together on complex innovative concepts. In the studied projects specialists worked together and developed multi disciplinary innovations.



Tools in **strategic** quality management contributed to the management of **all** innovation processes in the Oikos project and stimulated the development and realization of innovations. Innovative **concepts** that were realized with the support of tools in **strategic** quality management were a sustainable concept for town and country planning and 600 mutually different sustainable houses.

6. Conclusion

Tools in **strategic** quality management do support the management of innovation. Tools of **strategic** quality management are useful in: creating the organizational conditions in which innovations can be developed; supervising and initiating innovation processes; producing innovation content; and implementing innovations in the primary processes of the organization. ‘Quality management of innovation’ appears to be a subset of ‘innovation management’, that **contributes** sometimes explicitly, and in most cases implicitly, to the development of innovations.

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